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REMARKS

The Office Action of September 24, 2003 has been carefully considered.

Claim 16 has now been amended to recite that the cast ingot has an as cast grain size between 270 and 800 µm. This new lower limit is in accordance with the value found in Table 2 on page 10 of the specification and is the value for Sample No. 8. From Table 5 on page 14 of the specification, it can be seen that Sample 8 was considered to be within the invention.

The preferred embodiment of 300 to 800 µm is now found in new claim 25.

Claims 16 through 24 have been rejected under 35 USC 103 over Miyasato et al in view of ASM Vol. 15 Casting.

The invention is directed to a partially recrystallized, rolled, forged or extruded aluminum alloy product more than 12 mm thick, which is produced by casting an aluminum alloy into a cast ingot having an as cast grain size between 270 and 800 µm which is heat treated by solution treating, quenching and artificial aging. The final wrought product has a fraction of recrystallized grains measured between one-quarter thickness and mid-thickness less than 35% by volume, and a characteristic intercept distance between recrystallized areas greater than 250 µm.

Miyasato et al discloses an aluminum alloy produced by generally the same process steps as the claimed invention which is described as being between 85 and 100% unrecrystallized. There is no disclosure of as cast grain size or characteristic intercept distance, but ASM Vol. 15 Casting has been cited for its disclosure of grain refining.

In response, it is noted that all of the three claimed properties, as cast grain size, percentage recrystallization

and characteristic intercept distance, are relevant to the final properties of the product.

In terms of the as cast grain size, it is noted that the prior art teachings are generally between 100 and 250 μm, whereas the claimed invention recites 270 to 800 μm, and thus is contrary to the teachings of the prior art.

Moreover, the characteristic intercept distance of the final wrought product must be greater than 250 μm, whereas the prior art teaches the characteristic intercept distance below 250 μm.

It can be seen from Tables 2 and 5 of the present specification that the as cast grain size greater than 270 μm is necessary to obtain a characteristic intercept distance greater than 250 μm. Thus, products 1, 5 and 8 all have an average intercept distance greater than 250 μm, and these are the products which also have an as cast grain size of at least 270 μm.

While the as cast grain size can, as is suggested in the Office action, be easily adjusted, it is only Applicant that has provided a reason for doing so.

Applicant has discovered that for rolled plates having substantially identical mechanical strengths but having been obtained from rolling ingots with different as cast grain sizes and thus different average intercept values, the fracture toughness is much different, and increases with increasing as cast grain size and intercept value.

Conventionally, for any given alloy, there is a tradeoff between mechanical strength and toughness. Ordinarily, it is necessary to improve both properties at the same time, for example by adjusting the alloy composition or the heat treatment, if it is desired to improve this compromise. This can be seen from Table 2 on page 10 of the present

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specification, in which the change from slow quenching to fast quenching for any particular example increases both the tensile yield strength and the fracture toughness.

The claimed invention enables improvement of the fracture toughness of known alloys, while keeping the mechanical strength constant. This can be seen from Table 2 in which tensile yield strength is virtually the same for all samples. The fracture toughness (K) depends on the as cast grain size, which can be confirmed from Figure 1. This dependence on as cast grain size is independent of the quenching rate, although the absolute values will depend on the quenching rate.

In Example 3, with results found in Table 5, fracture toughness determinations are made for the final plate, as a function of the average intercept distance. It can be seen from Table 5 that the examples according to the invention with an average intercept distance greater than 250 μm provide the best fracture toughness values.

Thus, the only the data of the present specification provides motivation for one of ordinary skill in the art to produce a wrought product having a characteristic intercept distance greater than 250 μm in order to improve fracture toughness independently of tensile yield strength. As the relationship between characteristic intercept distance (and as cast grain size and recrystallization fraction) is not disclosed suggested in the cited art, withdrawal of this rejection is requested.

Claims 16 through 24 have been rejected under 35 USC 103 over Shahani et al in view of ASM Vol. 15 Casting.

Shahani et al has also been cited for its teaching of a partially recrystallized AlZnMgCu alloy product and the Office action alleges that it would have been obvious to utilize grain refining elements as taught in the ASM reference to

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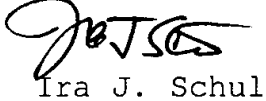
obtain a finer grain structure within the claimed 300 to 800 μm range. However, as noted above, the cited reference provides no motivation for doing so. The sole motivation for using the as cast grain size and recrystallization fraction to obtain a characteristic intercept distance greater than 250 μm is the teaching of the invention that obtaining the claimed characteristic intercept distance results in improved fracture toughness.

Withdrawal of this rejection is accordingly requested.

In view of the foregoing amendments and remarks, Applicant submits that the present application is now in condition for allowance. An early allowance of the application with amended claims is earnestly solicited.

Respectfully submitted,



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